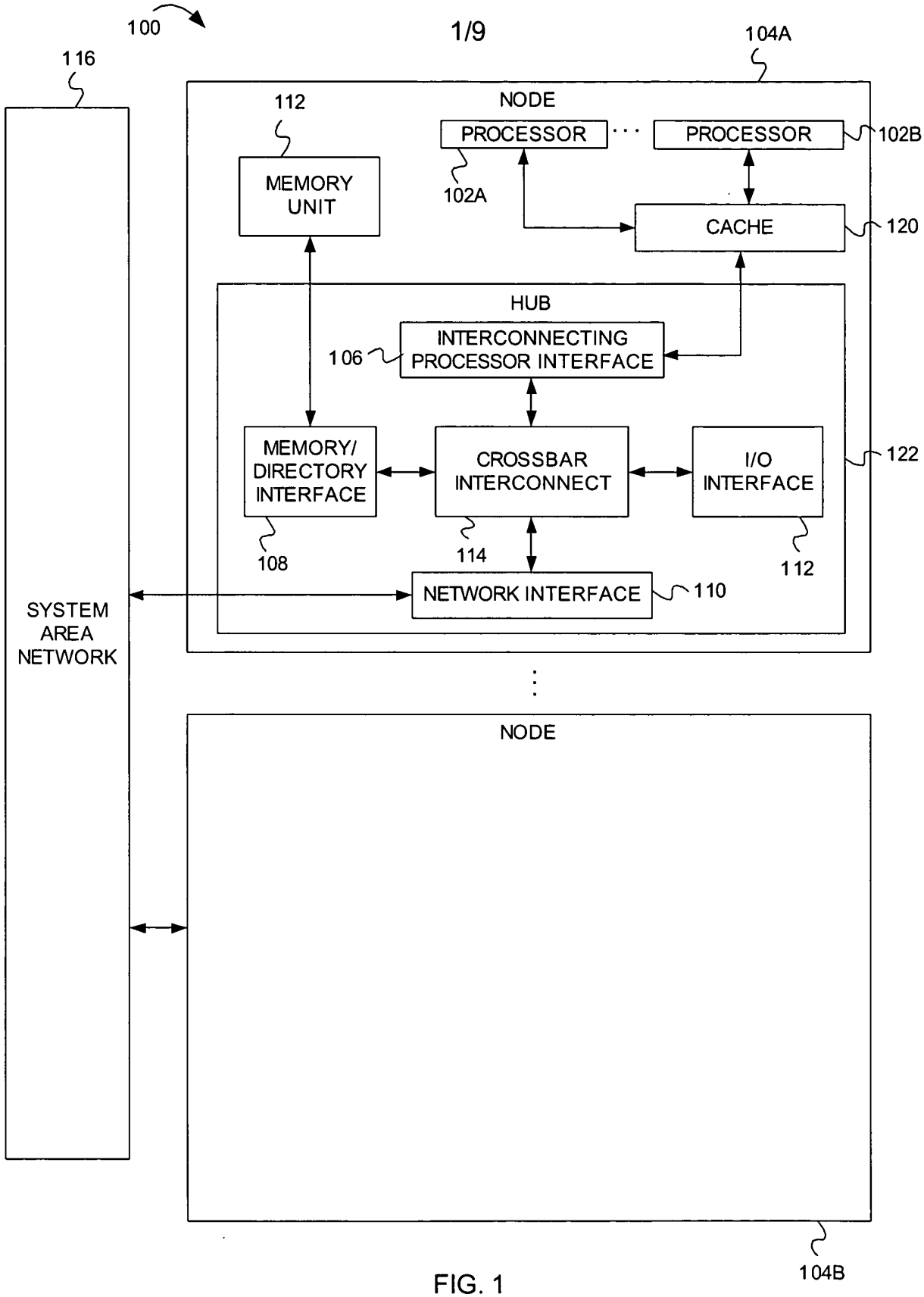
100
116
104A
112
NODE
PROCESSOR
PROCESSOR
102B
MEMORY UNIT
102A
CACHE
120
HUB
106
INTERCONNECTING PROCESSOR INTERFACE
MEMORY/ DIRECTORY INTERFACE
CROSSBAR INTERCONNECT
I/O INTERFACE
122
108
114
112
NETWORK INTERFACE
110
SYSTEM AREA NETWORK
NODE
104B

FIG. 1

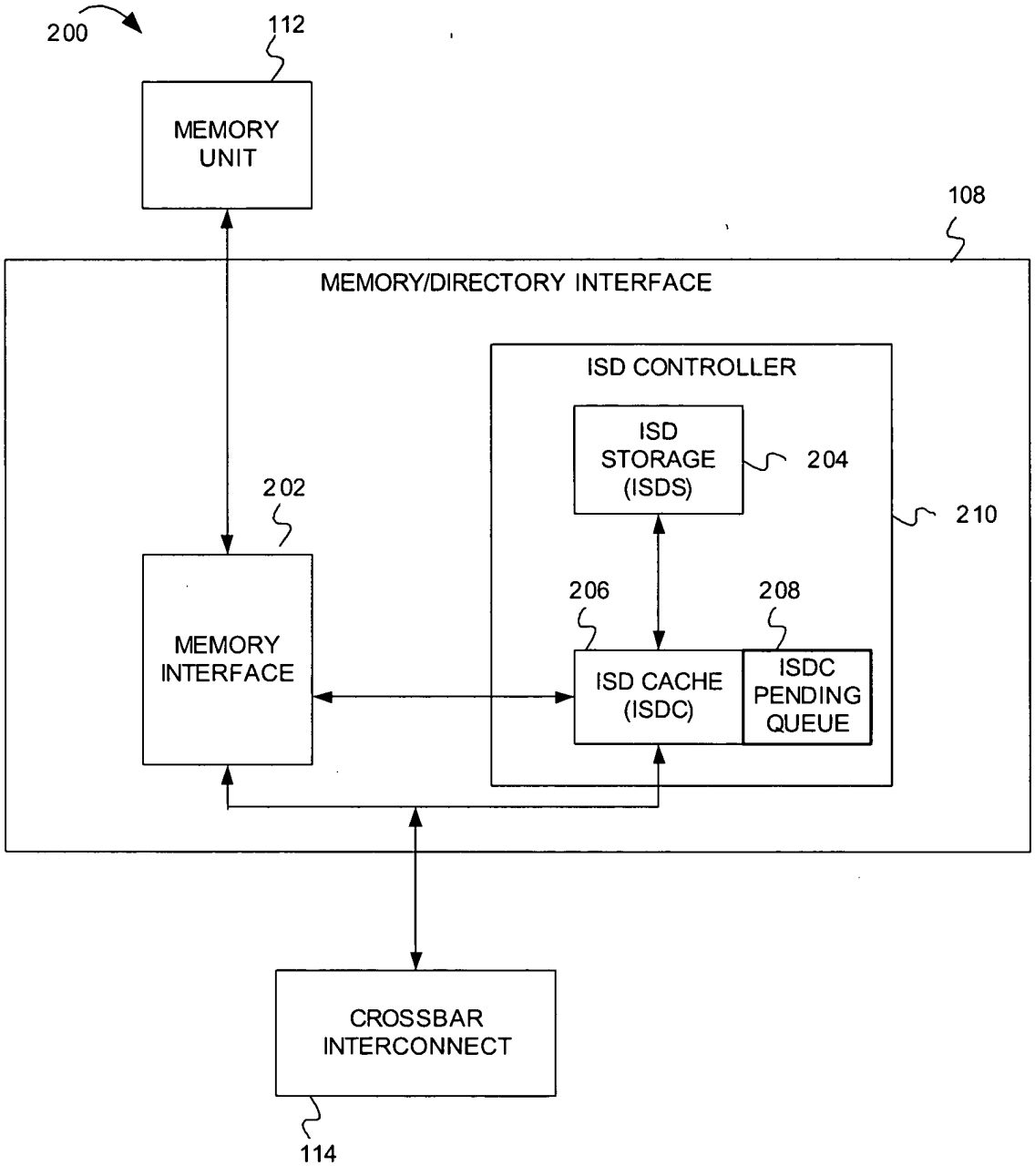
200
112
MEMORY UNIT
108
MEMORY/DIRECTORY INTERFACE
ISD CONTROLLER
ISD STORAGE (ISDS)
204
210
202
206
208
MEMORY INTERFACE
ISD CACHE (ISDC)
ISDC PENDING QUEUE
CROSSBAR INTERCONNECT
114

FIG. 2

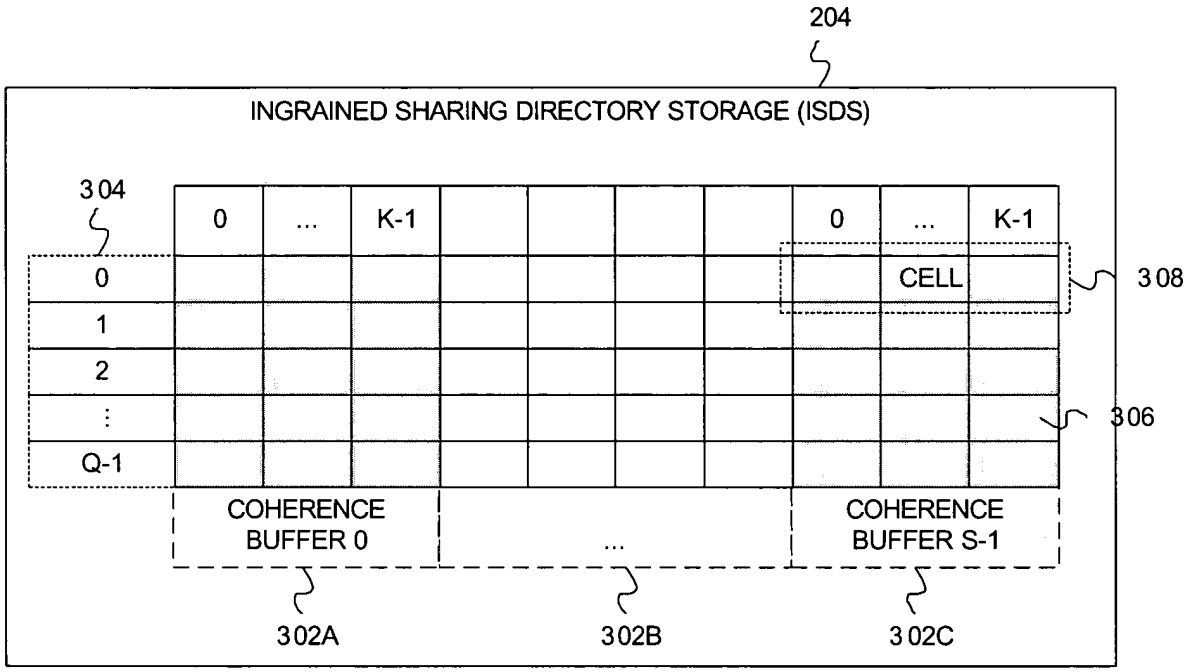
204
INGRAINED SHARING DIRECTORY STORAGE (ISDS)
304
0
...
K-1
0
...
K-1
0
CELL
308
1
2
306
Q-1
COHERENCE BUFFER 0
...
COHERENCE BUFFER S-1
302A
302B
302C

FIG. 3

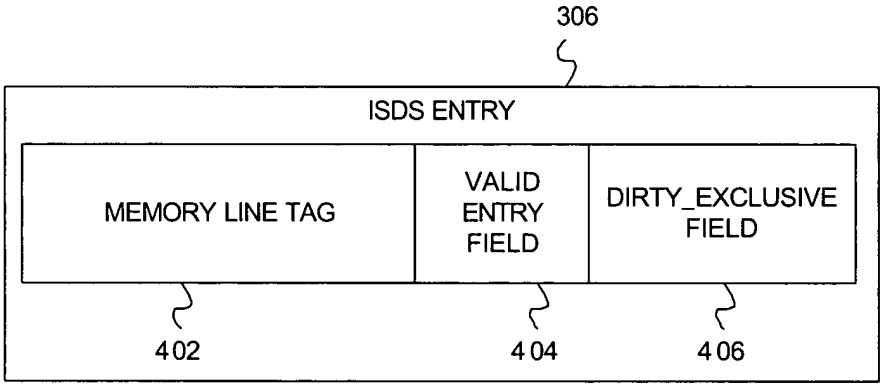
306
ISDS ENTRY
MEMORY LINE TAG
VALID ENTRY FIELD
DIRTY_EXCLUSIVE FIELD
402
404
406

FIG. 4

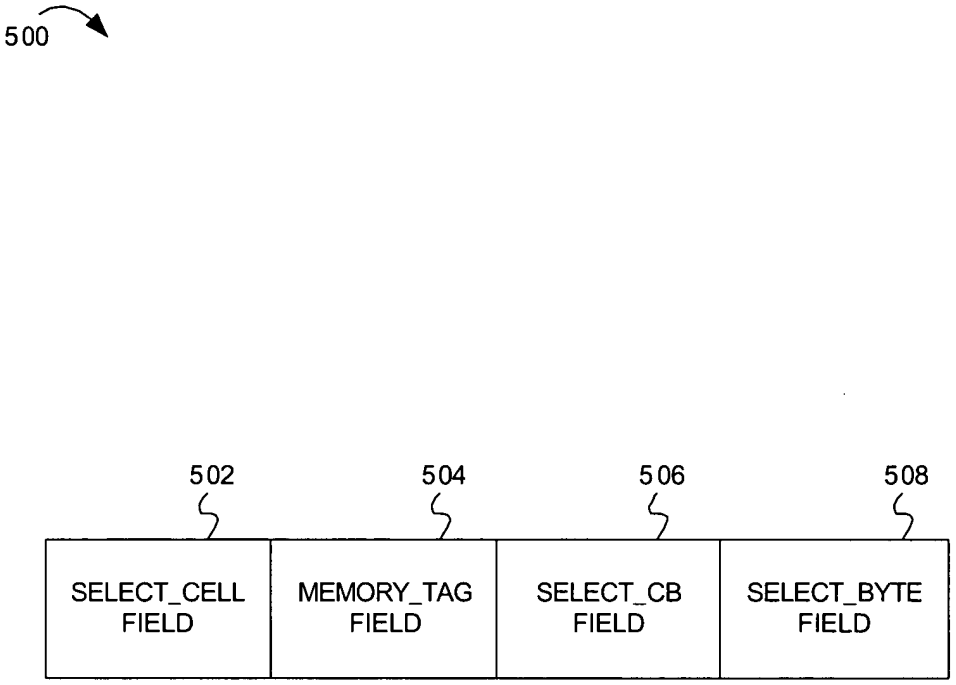
500
502
504
506
508
SELECT_CELL FIELD
MEMORY_TAG FIELD
SELECT_CB FIELD
SELECT_BYTE FIELD

FIG. 5

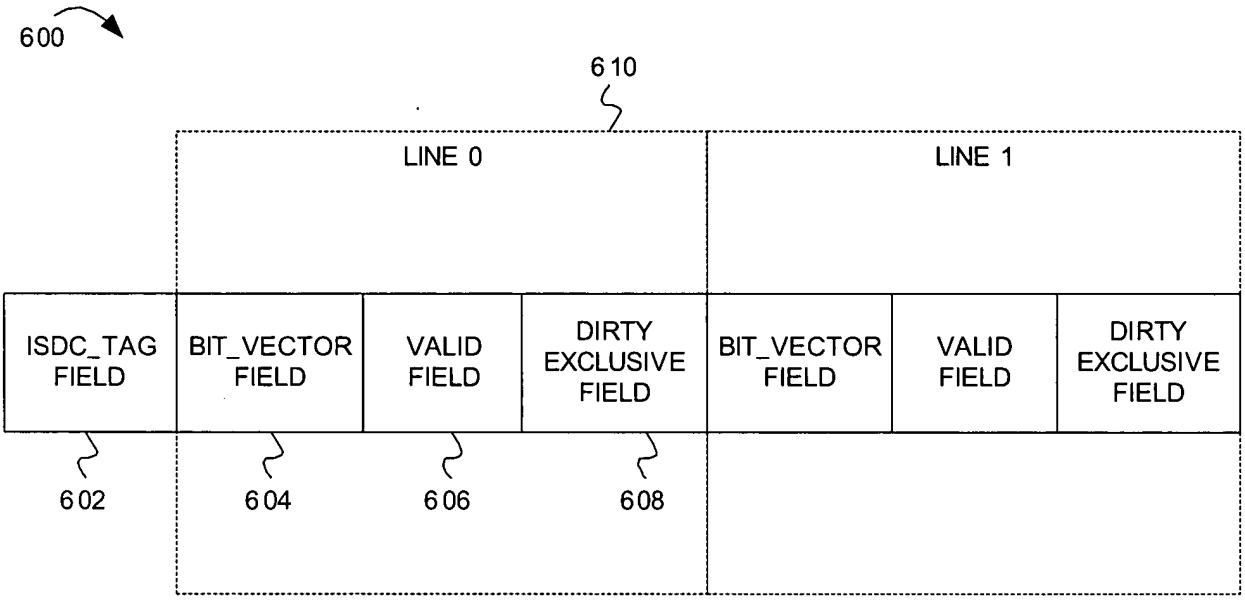
600
610
LINE 0
LINE 1
ISDC_TAG FIELD
BIT_VECTOR FIELD
VALID FIELD
DIRTY EXCLUSIVE FIELD
BIT_VECTOR FIELD
VALID FIELD
DIRTY EXCLUSIVE FIELD
602
604
606
608

FIG. 6

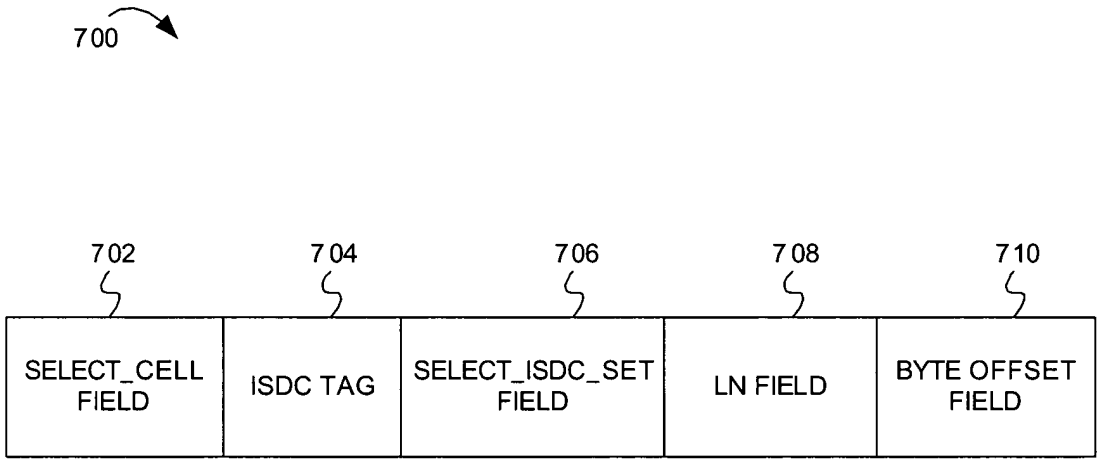
700
702
704
706
708
710
SELECT_CELL FIELD
ISDC TAG
SELECT_ISDC_SET FIELD
LN FIELD
BYTE OFFSET FIELD

FIG. 7

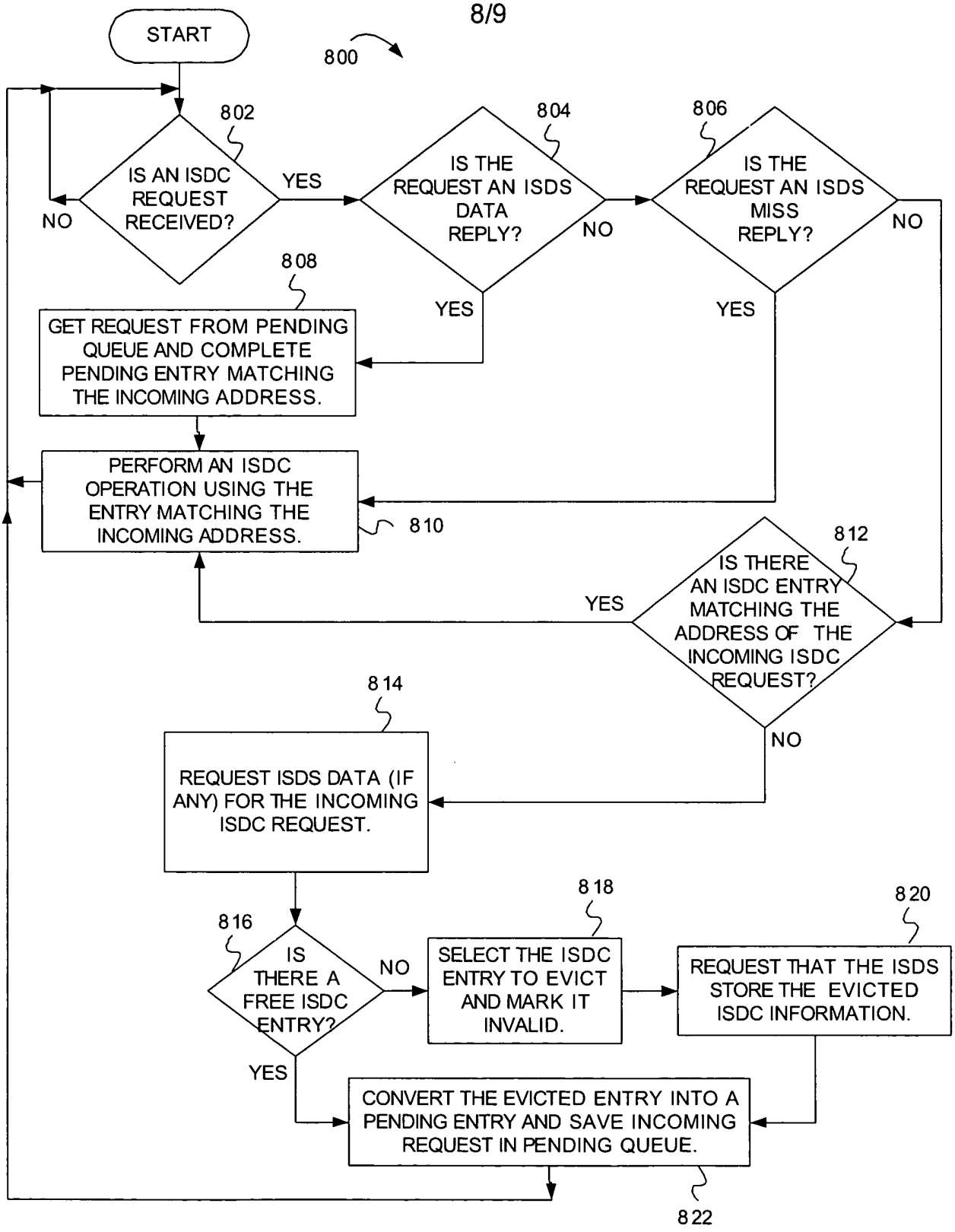
START
800
802
IS AN ISDC REQUEST RECEIVED?
NO
YES
804
IS THE REQUEST AN ISDS DATA REPLY?
NO
YES
806
IS THE REQUEST AN ISDS MISS REPLY?
NO
YES
808
GET REQUEST FROM PENDING QUEUE AND COMPLETE PENDING ENTRY MATCHING THE INCOMING ADDRESS.
PERFORM AN ISDC OPERATION USING THE ENTRY MATCHING THE INCOMING ADDRESS.
810
812
IS THERE AN ISDC ENTRY MATCHING THE ADDRESS OF THE INCOMING ISDC REQUEST?
YES
NO
814
REQUEST ISDS DATA (IF ANY) FOR THE INCOMING ISDC REQUEST.
816
IS THERE A FREE ISDC ENTRY?
NO
YES
818
SELECT THE ISDC ENTRY TO EVICT AND MARK IT INVALID.
820
REQUEST THAT THE ISDS STORE THE EVICTED ISDC INFORMATION.
CONVERT THE EVICTED ENTRY INTO A PENDING ENTRY AND SAVE INCOMING REQUEST IN PENDING QUEUE.
822

FIG. 8

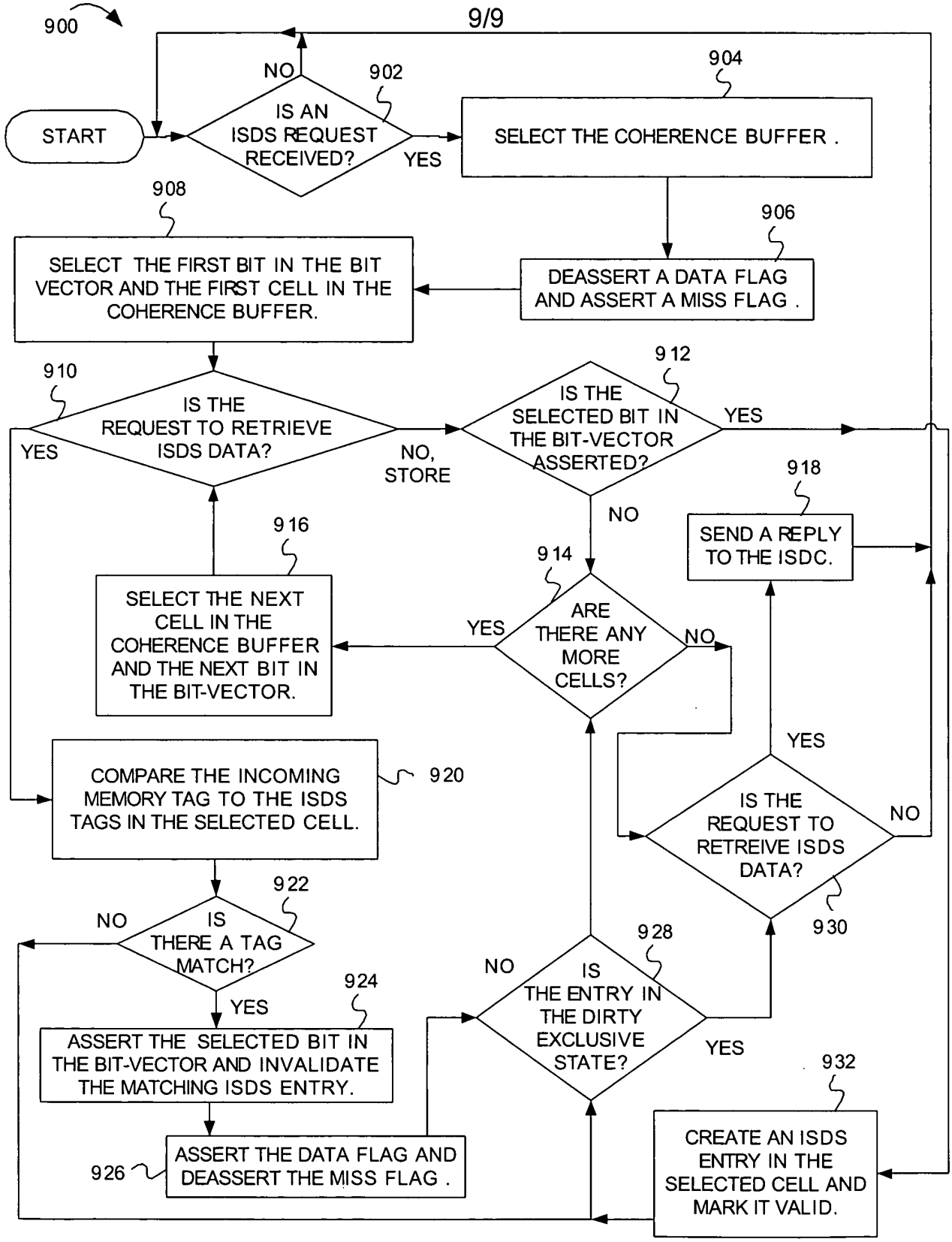
900
START
902
IS AN ISDS REQUEST RECEIVED?
NO
YES
904
SELECT THE COHERENCE BUFFER .
906
DEASSERT A DATA FLAG AND ASSERT A MISS FLAG .
908
SELECT THE FIRST BIT IN THE BIT VECTOR AND THE FIRST CELL IN THE COHERENCE BUFFER.
910
IS THE REQUEST TO RETRIEVE ISDS DATA?
YES
NO, STORE
912
IS THE SELECTED BIT IN THE BIT-VECTOR ASSERTED?
YES
NO
914
ARE THERE ANY MORE CELLS?
YES
NO
916
SELECT THE NEXT CELL IN THE COHERENCE BUFFER AND THE NEXT BIT IN THE BIT-VECTOR.
918
SEND A REPLY TO THE ISDC.
920
COMPARE THE INCOMING MEMORY TAG TO THE ISDS TAGS IN THE SELECTED CELL.
922
IS THERE A TAG MATCH?
NO
YES
924
ASSERT THE SELECTED BIT IN THE BIT-VECTOR AND INVALIDATE THE MATCHING ISDS ENTRY.
926
ASSERT THE DATA FLAG AND DEASSERT THE MISS FLAG .
928
IS THE ENTRY IN THE DIRTY EXCLUSIVE STATE?
NO
YES
930
IS THE REQUEST TO RETREIVE ISDS DATA?
YES
NO
932
CREATE AN ISDS ENTRY IN THE SELECTED CELL AND MARK IT VALID.

FIG. 9